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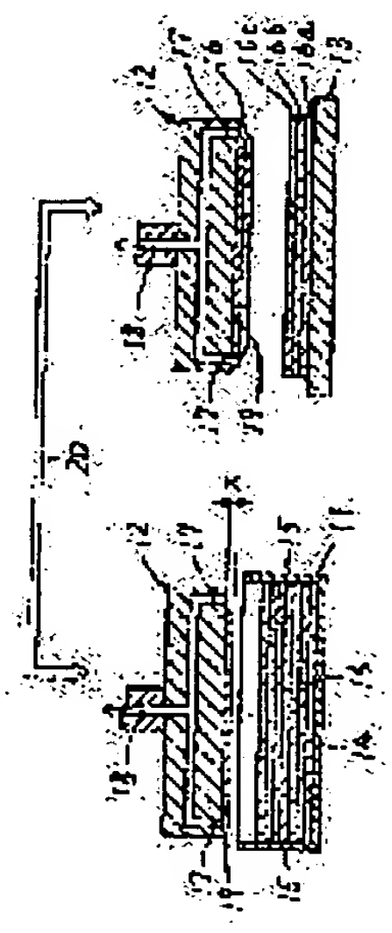
(54) MANUFACTURE OF CERAMIC-LAMINATED ELECTRONIC PARTS

(57)Abstract:

PURPOSE: To perform the lamination process of a plurality of ceramic green sheets with high areal productivity, which is included in the manufacture of ceramic lamination electronic parts.

CONSTITUTION: In respective inner parts of plural trays 11 equipped with a bottom surface wall 14 and a side surface wall 15, a plurality of ceramic green sheet 16 are housed in a laminated state. From the inner parts of these plural trays 11, the ceramic green sheet 16 is sucked by a sucking head 12 one by one in accordance with a predetermined order, and while transporting by this sucking head 12, lamination of the ceramic green sheet 16 is effected above a lamination station 13.



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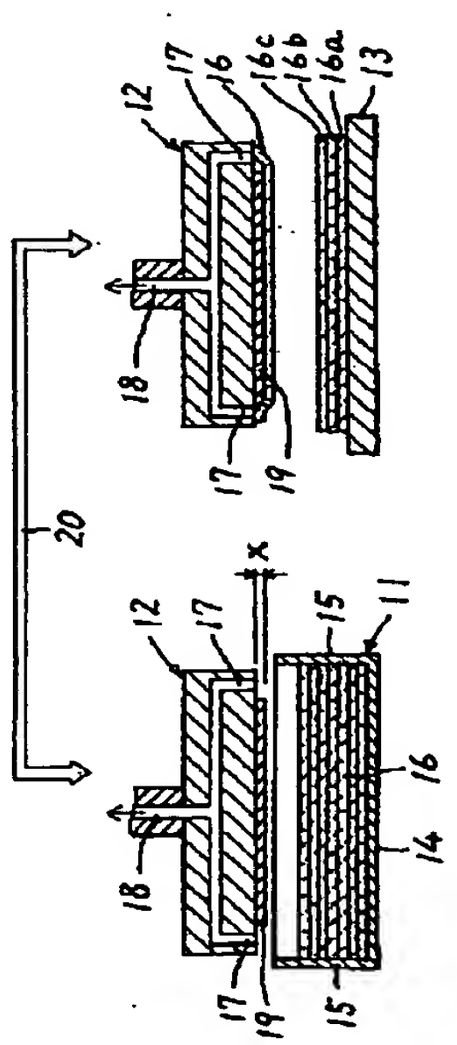
(54)【発明の名称】　セラミツク積層電子部品の製造方法

(57)【要約】
【目的】　セラミック積層電子部品の製造に含まれる複数枚のセラミックグリーンシートの積重ね工程を高い面積生産性をもって行なう。
【構成】底面壁１４および側面壁１５を備える複数個のトレー１１の各々内に、複数枚のセラミックグリーンシート１６を積み重ねた状態で収容する。これら複数個のトレー１１内から、所定の順序に従って、セラミックグリーンシート１６を１枚ずつ吸着ヘッド１２によって吸着し、この吸着ヘッド１２によって搬送しながら、積重ねステーション１３上においてセラミックグリーンシート１６の積重ねを行なう。



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【特許請求の範囲】

【請求項１】　底面壁および前記底面壁の周縁部から立上がる側面壁を備え、各々の内部に複数枚のセラミックグリーンシートが積重ねられた状態で収容された、複数個のトレーを準備し、前記トレー内の前記セラミックグリーンシートの最も上のものを真空吸引により吸着する吸着ヘッドを準備する、各ステップを備えるとともに、前記複数個のトレー内から、所定の順序に従って、前記セラミックグリーンシートを前記吸着ヘッドにより吸着するステップと、前記セラミックグリーンシートを吸着した前記吸着ヘッドを積重ねステーションにまで移動させるステップと、前記セラミックグリーンシートを前記積重ねステーション上に置くステップとが繰返される、セラミック積層電子部品の製造方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】この発明は、セラミック積層電子部品の製造方法に関するもので、特に、セラミック積層電子部品の製造において含まれるセラミックグリーンシートの積重ね方法に関するものである。

【０００２】

【従来の技術】セラミック多層基板や積層セラミックコンデンサのようなセラミック積層電子部品を製造する場合、複数枚のセラミックグリーンシートを積重ねることが行なわれる。このとき、積重ねられるべきセラミックグリーンシートは、少なくとも２種類あり、これらの種類のセラミックグリーンシートを所定の順序に従って積重ねなければならない。たとえば、セラミック多層基板の場合には、積重ねられるべきセラミックグリーンシートとしては、バイアホールの存否および形成態様、電極の存否および形成態様、等に応じて、複数種類のものがある。

【０００３】図５には、セラミックグリーンシートの積重ね工程で用いられるトレー１が斜視図で示されている。トレー１は、平板状をなしており、その上には、同じ種類のセラミックグリーンシート２が、１枚ずつ平面的に並べられている。上述のように、複数種類のセラミックグリーンシートを積重ねる場合には、図６に示すように、所望のセラミックグリーンシート２Ａ，…，２Ｅがそれぞれ並べられたトレー１Ａ，…，１Ｅが用意される。これらトレー１Ａ，…，１Ｅは、それぞれの上に置かれたセラミックグリーンシート２Ａ，…，２Ｅを取上げやすいようにするため、平面的に置かれる。そして、図６において矢印で示すように、積重ねステーション３まで、作業者の手によって、あるいは、真空吸引を行なう吸着ヘッドによって、セラミックグリーンシート２Ａ，…，２Ｅの各々が、所定の順序に従って、１枚ずつ運ばれ、積重ねステーション３上において、積重ねが行なわれる。

【０００４】

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【発明が解決しようとする課題】しかしながら、上述のような従来のセラミック積層電子部品の製造方法によれば、次のような問題に遭遇することがある。

【０００５】すなわち、セラミック多層基板のように、積重ねられるべきセラミックグリーンシートの種類が、たとえば１０～２０種類というように多い場合、このような種類の数と同じ数だけトレーが必要となるので、トレーが占有する面積が広くなり、面積生産性が低下する。

【０００６】また、各々のトレー上において、複数のセラミックグリーンシートが平面的に並べられているので、積重ね工程を進めるにあたっては、このようなトレーの各々上の異なる場所から特定のセラミックグリーンシートを取上げる必要がある。したがって、このような取り上げに用いられるたとえば吸着ヘッドの動きが複雑となり、それゆえに、積重ね工程を自動化することが困難である。

【０００７】それゆえに、この発明の目的は、面積生産性が高められ、かつ、自動化が容易なセラミック積層電子部品の製造方法を提供しようとすることである。

【０００８】

【課題を解決するための手段】この発明では、まず、底面壁および前記底面壁の周縁部から立上がる側面壁を備える、複数個のトレーが用いられる。これらトレー内には、複数枚のセラミックグリーンシートが積重ねられた状態で種類に応じて分別されて収容される。他方、トレー内のセラミックグリーンシートの最も上のものを真空吸引により吸着する吸着ヘッドが用意される。そして、これらのセラミックグリーンシートを積重ねるにあたって、複数個のトレー内から、所定の順序に従って、セラミックグリーンシートを吸着ヘッドにより吸着するステップと、セラミックグリーンシートを吸着した吸着ヘッドを積重ねステーションにまで移動させるステップと、セラミックグリーンシートを積重ねステーション上に置くステップとが繰返される。

【０００９】

【発明の効果】この発明によれば、積重ね工程に供される複数枚のセラミックグリーンシートが積重ねられた状態で各トレーに収容されるので、従来のトレーに平面的に複数枚のセラミックグリーンシートを並べる場合に比べて、複数個のトレーが占有する面積を低減することができ、したがって、面積生産性を向上させることができる。このことは、特にセラミック多層基板のように、多種類のセラミックグリーンシートを積重ねる場合において、より有利である。

【００１０】また、トレー内に収容された複数枚のセラミックグリーンシートは、水平方向に関してトレーの側面壁によって位置決めされるので、１つのトレー内に収容されている複数枚のセラミックグリーンシートは、水平方向に関しては、すべて同じ位置にある。それゆえ

に、吸着ヘッドは、同じ位置にて同じ種類のセラミックグリーンシートを吸着することができるので、吸着ヘッドの動きがそれほど複雑にならず、したがって、積重ね工程の自動化を容易に行なうことができる。このことは、セラミック積層電子部品のコストダウンにもつながる。

【００１１】

【実施例】図１は、この発明の一実施例を実施している状態を示す断面図である。図１には、トレー１１、吸着ヘッド１２、および積重ねステーション１３が示されている。

【００１２】トレー１１は、図２において斜視図で示されている。図１および図２を参照して、トレー１１は、矩形の底面壁１４およびこの底面壁１４の周縁部から立上がる４つの側面壁１５を備える。トレー１１内には、同じ種類の複数枚のセラミックグリーンシート１６が積重ねられた状態で収容されている。これらのセラミックグリーンシート１６は、得ようとするセラミック積層電子部品の種類または設計に応じて、バイアホールが形成されたものであったり、電極が印刷されたものであったり、あるいは、外層シートであったりする。

【００１３】吸着ヘッド１２の底面図が、図３に示されている。図１および図３を参照して、吸着ヘッド１２は、複数個の吸引穴１７を備え、これら吸引穴１７には、真空経路１８を介して、真空吸引が選択的に与えられる。吸引穴１７は、吸着ヘッド１２の周縁部のみに分布される。

【００１４】好ましくは、吸着ヘッド１２の下面であって、吸引穴１７によって取り囲まれた領域に、段差部１９が設けられる。この段差部１９の作用については、以下の説明によって明らかにする。

【００１５】吸着ヘッド１２は、矢印２０で示すように、トレー１１と積重ねステーション１３との間で移動される。すなわち、図１の左側に示すように、吸着ヘッド１２は、トレー１１の上方に位置されたとき、トレー１１内のセラミックグリーンシート１６の最も上のものに接触するまで、下方へ変位される。このとき、吸引穴１７を介して真空吸引が与えられているので、セラミックグリーンシート１６の最も上のものが真空吸引により吸着ヘッド１２に吸着される。次いで、吸着ヘッド１２は、矢印２０で示すように、積重ねステーション１３の上方に位置され、さらに下方へ変位される。そして、吸引穴１４を介して与えられていた真空吸引が解除され、吸着ヘッド１２によって吸着されていたセラミックグリーンシート１６が積重ねステーション１３上に置かれる。積重ねステーション１３上には、すでに積重ねられたセラミックグリーンシート１６ａ，１６ｂ，１６ｃが示されている。

【００１６】図１の右側において、吸着ヘッド１２に吸着されているセラミックグリーンシート１６が図示されている。このセラミックグリーンシート１６は、段差部１９の存在のために、全体として下方へ湾曲した状態となっており、その周縁部のみにおいて吸引穴１７を介して真空吸引されている。このようなセラミックグリーンシート１６の吸着形態は、セラミックグリーンシート１６自身が有する粘着力によってその下にあるセラミックグリーンシート１６に付着することを防止する。すなわち、吸着ヘッド１２によって吸着されるセラミックグリーンシート１６は、真空吸引の初期の段階において、その周縁部のみがまず上方へ反らされるため、空気がその下にあるセラミックグリーンシート１６との間に素早く入り、それらの付着を防止する。したがって、吸着ヘッド１２は、２枚以上のセラミックグリーンシート１６を吸着することがなく、確実に１枚のセラミックグリーンシート１６のみを吸着する。そのため、このような吸着ヘッド１２を用いれば、セラミックグリーンシート１６の積重ねの信頼性が高められる。また、このことは、積重ね工程の自動化をもより容易にする。

【００１７】なお、段差部１９によってあたえられる段差ｘは、吸着されるべきセラミックグリーンシート１６の主として厚みに応じて最適値が存在する。段差ｘは、セラミックグリーンシートの厚みが薄い場合には、セラミックグリーンシートが反りやすく、２枚以上吸着する可能性が高められるため、段差ｘは大きいほうが好ましい。逆に、セラミックグリーンシートの厚みが厚い場合には、セラミックグリーンシート自身の強度があり、反りにくいため、段差ｘは小さいほうがよい。

【００１８】なお、段差ｘの最適値は、その他、セラミックグリーンシートの材質、すなわち、バインダおよび可塑剤の種類および量などによっても影響されることがある。

【００１９】図１に示した積重ね工程は、実際には、図４に示すように実施される。図４に示すように、複数個のトレー１１Ａ，１１Ｂ，１１Ｃ，１１Ｄ，…，１１Ｅが配置され、トレー１１Ａ～１１Ｅの各々には、それぞれ同じ種類のセラミックグリーンシート１６Ａ，１６Ｂ，１６Ｃ，１６Ｄ，…，１６Ｅが積重ねられた状態で収容される。そして、図１に示した吸着ヘッド１２によって、図４において矢印で示すように、複数個のトレー１１Ａ～１１Ｅ内から、所定の順序に従って、セラミックグリーンシート１６Ａ～１６Ｅが吸着され、積重ねステーション１３にまで移動され、積重ねステーション上においてセラミックグリーンシート１６の積重ねが行なわれる。

【図面の簡単な説明】

【図１】この発明の一実施例を実施している状態を示す断面図である。

【図２】図１に示した複数枚のセラミックグリーンシート１６を収容しているトレー１１を示す斜視図である。

【図３】図１に示した吸着ヘッド１２の底面図である。

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【図4】図1に示した工程に従って、複数個のトレー11A～11Eの各々に収容されているセラミックグリーンシート16A～16Eに対して積重ねステーション13上において積重ねを行なっている状態を図解的に示す斜視図である。

【図5】従来の方法において用いられていたトレー1およびその上に並べられたセラミックグリーンシート2を示す斜視図である。

【図6】図5に示した複数個のトレー1A～1Eを用いてセラミックグリーンシート2A～2Eの積重ねを実施している状態を図解的に示す斜視図である。

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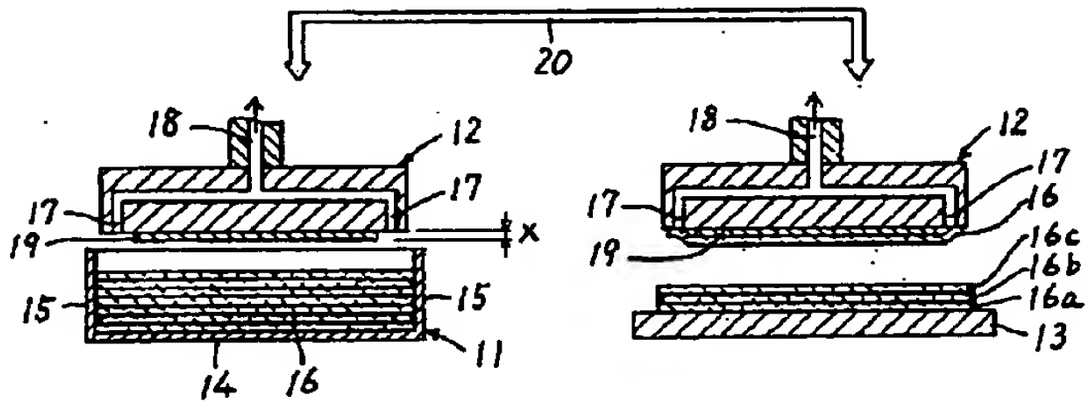
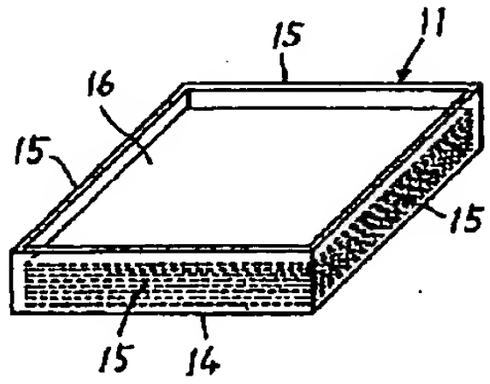
【符号の説明】

11，11A～11E　トレー
12　吸着ヘッド
13　積重ねステーション
14　底面壁
15　側面壁
16，16a～16c，16A～16E　セラミックグリーンシート
17　吸引穴
19　段差部

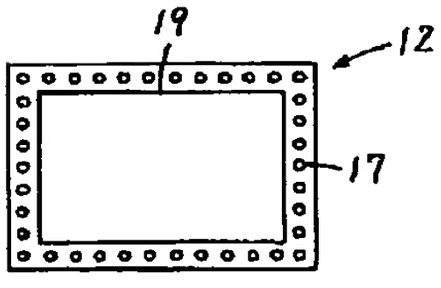
【図1】



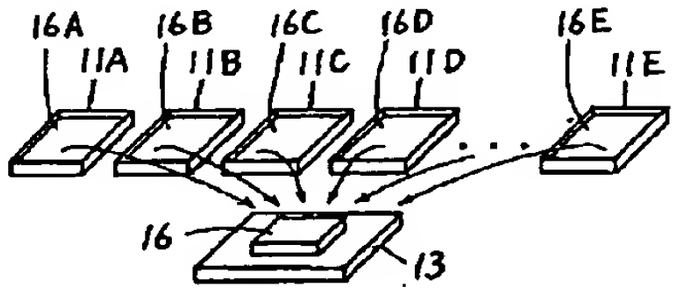
【図2】



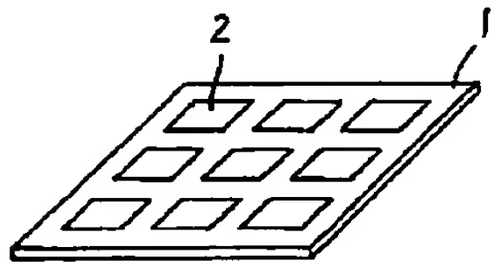
【図3】



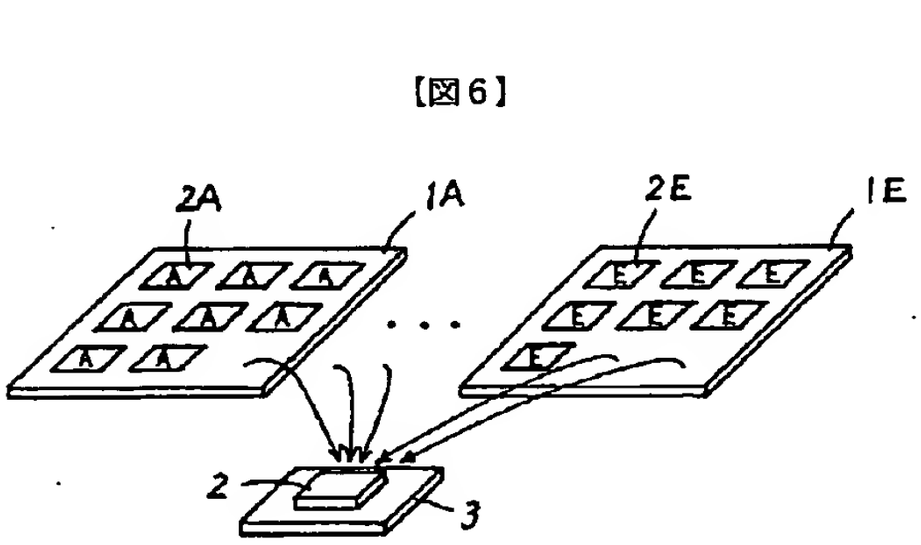
【図4】



【図5】



【図6】



* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] In case this invention manufactures laminating ceramic electronic parts, such as a stacked type ceramic condenser and a laminating ceramic inductor, it relates to the method of carrying out the laminating of the ceramic green sheet.
[0002]
[Description of the Prior Art] Many dielectric ceramic layers in which the stacked type ceramic condenser which is the most typical example of laminating ceramic electronic parts has an internal electrode are accumulated, and the internal electrode is pulled out by turns by the end face of a layered product. And the external electrode is formed in the end face of the layered product by which these internal electrodes were pulled out.
[0003] Such a laminating ceramic condenser has a layer structure as shown in drawing 8 . That is, a laminating is carried out to the dielectric layer 63 which has internal electrodes 65 and 66, and the sequence which 63 -- shows by drawing 8 , and the two or more layers dielectric layers 67 and 68 by which the internal electrode is not further formed in the both sides are accumulated. And the external electrode which is not illustrated by the end face which the internal electrodes 65 and 66 of such a layered product exposed is formed.
[0004] The manufacture method that such laminating ceramic electronic parts are not necessarily manufactured separately, and an one part unit as usually shown in drawing 8 shows them below in practice is taken. That is, the ceramic powder and the organic binder which turned minutely first are kneaded, a slurry is made, this is thinly developed on the carrier film of the shape of a long picture tape by the doctor blade method, it dries and a long picture ceramic green sheet is made. Next, on the ceramic green sheet which appeared on this carrier film, an electric conduction paste is printed, it dries with screen printing, and the internal-electrode patterns 2a and 2b as shown in a view 7 are printed by turns. The tape of a bilayer [finishing / this printing] is once rolled round by the roll. And the roll of the tape of this bilayer is set in decision laminating equipment as a supply roll, it lets out the tape of a bilayer from this supply roll, and a green sheet is exfoliated from the above-mentioned carrier tape on the way. The ceramic green sheet separated from the carrier tape is carried on a carrier belt, and is judged by the predetermined size by the decision adsorption unit here like the ceramic green sheets 1a and 1b as shown in drawing 9 . Then, these judged ceramic green sheets 1a and 1b are conveyed in another laminating position, and a laminating is carried out by turns.
[0005] Next, as shown in drawing 9 , the laminating of the ceramic green sheets 1a and 1b of two or more sheets which have the aforementioned internal-electrode patterns 2a and 2b is carried out, further, the internal-electrode patterns 2a and 2b are had and twisted, how many sheets of those ceramic green sheets 1 and 1 are accumulated up and down, these are stuck further by pressure, and a layered product is made. Here, the aforementioned ceramic green sheets 1a and 1b accumulate by turns the things 1a and 1b from which the internal-electrode patterns 2a and 2b shifted to the longitudinal direction by half length, and stick them by pressure. Then, it cuts in the size of a request of this layered product, a

laminating student chip is manufactured, and this raw chip is calcinated. In this way, the obtained laminating chip is a layered product of a cube form which has the electrodes 2a and 2b exposed to the ends side by turns. Next, by applying and baking an electric conduction paste on the ends of a laminating chip of finishing [this baking], an electrode terminal is formed in ends and a stacked type ceramic condenser is completed.

[0006] The laminating ceramic electronic parts represented by such laminating ceramic condenser need to accumulate internal-electrode patterns, such as the above internal-electrode patterns, with a sufficient precision, otherwise a desired electrical property is not acquired. However, since the miniaturization of laminating ceramic electronic parts progresses and the thickness of a ceramic green sheet is still thinner, the elongation of a ceramic green sheet and a position gap tend to take place, and it is hard to secure sufficient laminating precision at the process which conveys and carries out the laminating of the judged ceramic green sheet, pressurizes further and carries out temporary sticking by pressure.

[0007] Then, in the former, a ceramic green sheet is judged in a predetermined configuration the whole carrier film in the state [having carried the ceramic green sheet on a carrier film], and while carrying out a laminating one by one, positioning a ceramic green sheet with a carrier film, the method of exfoliating a carrier film is proposed.

[0008]

[Problem(s) to be Solved by the Invention] However, by the laminating method of this ceramic green sheet, the side by which the internal-electrode pattern of a ceramic green sheet was printed is turned down, and since a laminating is carried out, a ceramic green sheet cannot be positioned with the positioning pattern printed with the internal-electrode pattern. Then, tooling holes are prepared in the position of the four corners of a ceramic green sheet with a carrier film. Carrying out alignment of the tooling holes to a gage pin, and inserting them in it on the laminating base which protruded the gage pin corresponding to these tooling holes Carry out alignment of a ceramic green sheet and a ceramic green sheet with a carrier film is conveyed after that on this positioning base and the laminating stage which has a positioning means to correspond. Then, the laminating of the ceramic green sheet is carried out, and the method of exfoliating a carrier film is proposed.

[0009] However, it is quite difficult to carry out alignment of the four tooling holes prepared in the four corners of a ceramic green sheet with a carrier film to four gage pins on a positioning base simultaneously, and to insert them in them. Therefore, even if it hit positioning by the robot using the manipulator and carrying out a laminating, positioning of the ceramic green sheet with a carrier film on a positioning base took time, and the technical problem that the cycle time will become long occurred. Then, this invention aims at offering the ceramic green-sheet laminating method that a ceramic green sheet with a carrier film can be positioned easily.

[0010]

[Means for Solving the Problem] Namely, in order to attain the aforementioned purpose, while being pierced by the fixed configuration in this invention The ceramic green sheet with a carrier film which prepared tooling holes in four corners It moves onto the positioning base where the gage pin protruded corresponding to the aforementioned tooling holes. A ceramic green sheet with the said carrier film is carried on a positioning base, carrying out alignment of two or the three tooling holes of a ceramic green sheet with a carrier film to the gage pin to which it corresponds on a positioning base, and inserting them in it. Then, after piling up a ceramic green sheet with a carrier film on other ceramic green sheets on the laminating stage which has a positioning means to insert other tooling holes in it and a corresponding gage pin, and to correspond with this positioning base after that, The carrier film on the piled-up ceramic green sheet is exfoliated, and the ceramic green-sheet laminating method characterized by only for the predetermined number of times repeating the aforementioned process below, and carrying out the laminating of the ceramic green sheet of predetermined number of sheets is offered.

[0011]

[Function] By the laminating method of the ceramic green sheet by this invention, alignment of two or three of those is carried out first, without carrying out alignment of all the tooling holes prepared in the four corners of a ceramic green sheet with a carrier film to the gage pin on a laminating base

simultaneously. For this reason, alignment of tooling holes and a gage pin can be performed easily. And if alignment of two or the three tooling holes is carried out to a gage pin and they are inserted in it, two or the one tooling holes remaining by making parallel a ceramic green sheet with a carrier film with a positioning base is naturally positioned by the gage pin corresponding to it, and can be inserted easily. Thereby, a ceramic green sheet with a carrier film can be correctly put on the position on a positioning base.

[0012]

[Example] Hereafter, the example of this invention is explained in detail, referring to a drawing. Drawing 1 is the plan showing the whole laminating equipment used for enforcing the laminating method of the ceramic green sheet by this invention. With this equipment, the magazine 11 which contains in piles the ceramic green sheet a with a carrier film beforehand judged by the predetermined configuration the whole carrier film up and down is used, and this magazine 11 is put on the magazine place 10. As shown in drawing 2 , the ceramic green sheet a with a carrier film of the rectangle judged between the supports 12 set up perpendicularly is accumulated up and down, and this magazine 11 contains it, and after the aforementioned support 12 has faced across each side where the ceramic green sheet a with a carrier film counters from both sides, it is positioned and held. Moreover, the ceramic green sheet a with a carrier film is contained by the magazine 11 so that a carrier film side may turn up.

[0013] Although two or more magazines 11 are put on the magazine place 10 as shown in drawing 1 , the ceramic green sheet which has the same internal-electrode pattern collects respectively, and is contained by each magazine 11, the ceramic green sheet which does not have an internal-electrode pattern further is also summarized at it, and it is contained by another magazine 11.

[0014] At the ceramic green sheet a with a carrier film contained by these magazines 11, four tooling-holes b is punched at the position of the four corners. Drawing 4 shows the example of the boring location of tooling-holes b punched at this ceramic green sheet a with a carrier film, and gets down, and tooling-holes b is respectively punched in this example on the outside of the adsorption position e by which adsorption maintenance is carried out with the sucker 25 of the adsorption head 22 of the manipulator 20 mentioned later. Although another magazine place 70 is arranged at the side of the aforementioned magazine place 10 as shown in drawing 1 , this magazine place 70 places the magazine 11 which contained the ceramic green sheet [finishing / a laminating] d.

[0015] The positioning base 30 shown in drawing 2 , drawing 3 , and drawing 5 is arranged at the opposite side of this magazine place 70, and four gage pins 31 protrude on this positioning base 30 corresponding to tooling-holes b punched at the aforementioned ceramic green sheet a with a carrier film. Moreover, this positioning base 30 has the air duct 32 (refer to drawing 5) for holding the ceramic green sheet a with a carrier film which made the base top negative pressure and carried it on it, and the ceramic green sheet a with a carrier film is adsorbed and held on the positioning base 30 by the air attracted through this air duct 32. As shown in drawing 1 , it has the manipulator 20 which is the first conveyance means which conveys the ceramic green sheet a with a carrier film over the aforementioned magazine places 10 and 70 and the positioning base 30. As shown in drawing 2 , it expands and contracts this arm 21, and this manipulator 20 has the arm 21 rotated by the rolling mechanism 23, and it has vertical SHIRINDA 24 at the nose of cam.

[0016] Furthermore, it adsorbs at the nose of cam of the plunger which this vertical cylinder 24 goes up and down on the carrier film front face of the ceramic green sheet a with a carrier film, and the adsorption head 22 holding this film is formed. From the inferior surface of tongue of this adsorption head 22, four suckers 25 are formed through the actuators 26, such as a pneumatic cylinder, and this sucker 25 adsorbs and holds the ceramic green sheet a with a carrier film by making the nose of cam into negative pressure there. In the example of illustration, four suckers 25 can be respectively gone up and down individually with the aforementioned actuator 26.

[0017] By being able to move over all the ranges of the magazine places 10 and 70 and the positioning base 30, and carrying out drive control of this manipulator 20 by computer, the adsorption head 22 of this manipulator 20 is beforehand defined from the magazine 11 on the magazine place 10, takes out the ceramic green sheet a with a carrier film in order of ****, and conveys it on the aforementioned

positioning base 30.
[0018] As shown in drawing 1 and drawing 3 , the laminating stage 40 is arranged near the positioning base 30. This laminating stage 40 is arranged free [movement to the longitudinal direction of drawing 1] along with a guide rail 43, and is moved by the move mechanism 41 which consists of a ball screw, a motor, etc. On this laminating stage 40, the gage pin 47 protrudes corresponding to the gage pin 31 on the aforementioned laminating stage 30.
[0019] Furthermore, when this laminating stage 40 stops near the positioning base 30, it has the manipulator 44 for laminatings which is the second conveyance means which conveys the ceramic green sheet a with a carrier film from on the positioning base 30 to the laminating stage 40. As shown in drawing 3 , this manipulator 44 for laminatings has the vertical cylinder 42 moved to right and left by the level cylinder 46 in drawing 3 , and the adsorption head 45 which moves up and down in this vertical cylinder 42. As shown in drawing 5 (c), it has the air duct 48 for this adsorption head 45 making negative pressure the adsorption side which is the inferior surface of tongue, and holding the ceramic green sheet a with a carrier film there, the ceramic green sheet a with a carrier film is adsorbed and held by the air attracted through this air duct 48 in the adsorption side, and the ceramic green sheet a with a carrier film is conveyed on the laminating stage 40 from on the positioning base 30. Moreover, corresponding to the gage pin 31, the crevice 49 is established in the adsorption side of the adsorption head 45, and when the adsorption head 45 descends, the gage pin 31 of the positioning base 30 fits into this crevice.
[0020] In drawing 1 of the aforementioned guide rail 43, the press machine 60 is arranged at the right end side. As shown in drawing 6 , this press machine 60 is pressurized heating from a top the ceramic green sheet a by which the laminating was carried out on this laminating stage 40, when the force-plunger board 61 having a heater (not shown) is made to go up and down and the laminating stage 40 is inserted in the bottom of it.
[0021] As furthermore shown in drawing 1 , the ablation roller 50 is arranged as a means to exfoliate a carrier film from the ceramic green sheet by which the laminating was carried out between this press machine 60 and the aforementioned manipulator 44 for laminatings. As shown in drawing 7 , this ablation roller 50 has the roller head 52 of the rotating cylindrical shape, and is moved up and down in drawing 1 along with a guide 51 while a peripheral surface is made into negative pressure. As shown in drawing 2 , the roller head 52 has the flat part 53 in a part of the peripheral surface.
[0022] Next, the laminating method of the ceramic green sheet by this invention using this equipment is explained. As shown in drawing 1 , a magazine 11 is respectively put on the position of the magazine place 10. The ceramic green sheet which has a predetermined internal-electrode pattern respectively, and the ceramic green sheet with a carrier film which does not have an internal-electrode pattern are contained by each [these] magazine 11.
[0023] In this state, as a solid line shows to drawing 2 , first, the adsorption head 22 of a manipulator 20 moves onto the predetermined magazine 11 put on the magazine place 10, and takes out the ceramic green sheet a with a carrier film from there, and as a two-dot chain line shows, it conveys on the positioning base 30. And as shown in drawing 5 (a), the adsorption head 22 adsorbs a carrier film side, conveys the ceramic green sheet a with a carrier film on the positioning base 30, and positions it through the tooling-holes b to the gage pin 31 on the positioning base 30.
[0024] Here, four all of tooling-holes b are not simultaneously positioned by the gage pin 31, but it is positioned by the gage pin 31 to which 2 of them or three correspond. When positioning two tooling-holes b, it is better than two tooling-holes b in the same side side of the ceramic green sheet a with a carrier film to position two tooling-holes b which is on the diagonal line mutually to it and the corresponding gage pin 31.
[0025] Next, as shown in drawing 5 (b), the adsorption head 22 is dropped, adsorption of the ceramic green sheet a with a carrier film with some suckers 25 is canceled, and tooling-holes b positioned first is inserted in the gage pin 31 on the positioning base 30. Alignment is naturally carried out to the gage pin 31 to which other two or one tooling-holes b corresponds by this, and they can be inserted in a gage pin 31. Thereby, the ceramic green sheet a with a carrier film is arranged at the position on the positioning

base 30. The ceramic green sheet a with a carrier film carried on the positioning base 30 is adsorbed and held on the positioning base 30 by the air attracted through an air duct 32.
[0026] Next, the adsorption head 45 of the manipulator 44 for laminatings shown in drawing 3 moves onto the positioning base 30, as drawing 5 (c) shows, and the ceramic green sheet a with a carrier film positioned there is adsorbed, and is held. When, as for the gage pin 31 on the positioning base 30, the adsorption head 45 descends at this time, it fits into this crevice 49.
[0027] Then, as are shown in drawing 5 (c), and the ceramic green sheet a with a carrier film is pulled up from on the positioning base 30 and it is shown in drawing 3 , this is conveyed to the laminating stage 40 and it places there. Here, a gage pin 47 fits into tooling-holes b of the ceramic green sheet a with a carrier film, and this ceramic green sheet a is positioned.
[0028] Then, the laminating stage 40 is moved to the bottom of the ablation roller 50 by the drive 41. Here, as shown in drawing 7 (a), the flat part 53 of the peripheral surface of the roller head 52 of the ablation roller 50 sticks to the edge of the carrier film c. Then, as shown in drawing 7 (b), while the roller head 52 rotates in the direction shown by the arrow, as an arrow shows, the ablation roller 50 whole moves rightward in drawing 7 (b) at the peripheral speed of the roller head 52, and uniform velocity, and exfoliates the carrier film c from the ceramic green sheet d. Then, the negative pressure of the peripheral surface of the roller head 52 is canceled, and the carrier film c is discarded.
[0029] Next, the laminating stage 40 returns to the position of the manipulator 44 for laminatings, and another ceramic green sheet a with a carrier film is put on it like the aforementioned operation. Subsequently, the laminating stage 40 is moved to the press machine 60 by the drive 41, and the force-plunger board 61 descends here, and it pressurizes, heating from a top the ceramic green sheet a by which the laminating was carried out on the laminating stage 40.
[0030] Next, the laminating stage 40 is moved to the bottom of the ablation roller 50 by the drive 41, and the carrier film c exfoliates from the ceramic green sheet d like the above here. Hereafter, similarly, the superposition to the laminating stage 40 top of the ceramic green sheet a with a carrier film, heating and pressurization, and ablation of the carrier film c are repeated in predetermined sequence, and the layered product d to which the laminating of the ceramic green sheet was carried out in the defined sequence is completed. Then, a manipulator 20 contains a layered product d at the magazine 11 on the magazine place 70.
[0031]
[Effect of the Invention] Since according to this invention a ceramic green sheet with a carrier film can be put on the position on a positioning base and can be easily positioned as explained above, an exact laminating becomes possible [carrying out by the short cycle time], and can aim at improvement in productivity.

[Translation done.]